9th Class 2016		
Math (Science)	Group-II	Paper-I
Time: 2.10 Hours	(Subjective Type)	Max. Marks: 60

(Part-I)

2. Write short answers to any Six (6) questions: 12

(i) Define rectangular matrix with example.

Ans A matrix is called rectangular if the number of rows is not equal to the number of columns.

$$A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}$$

$$B = \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$$

(ii) If $A = \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$, then find AB.

Ans

$$A = \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$$

$$AB = \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}\begin{bmatrix} 6 \\ 5 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \times 6 + 0 \times 5 \\ -1 \times 6 + 2 \times 5 \end{bmatrix}$$

$$= \begin{bmatrix} 18 + 0 \\ -6 + 10 \end{bmatrix}$$

$$= \begin{bmatrix} 18 \\ 4 \end{bmatrix}$$

(iii) Evaluate: $(-i)^5$.

Ans

$$(-i)^5 = (-1 \times i)^5$$
$$= (-1)^5 \times (i)^5$$
$$= (-1)(i^4 \cdot i)$$
$$= (-1)(i^2)^2 \times i$$
$$= (-1)(-1)^2 \times i$$
$$= (-1)(1) \times i$$
$$= -i$$

(iv) Simplify: $(x^3)^2 \div x^{3^2}$.

Ans $(x^3)^2 \div x^{3^2} = x^6 \div x^9$

$= x^6 \times x^{-9}$

$= x^{6-9}$

$= x^{-3}$

$= \frac{1}{x^3}$

(v) Prove that: $\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n.$

Ans $\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n$

Let $\log_a m = x$ and $\log_a n = y$

$a^x = m$ and $a^y = n$

$\frac{a^x}{a^y} = \frac{m}{n} \Rightarrow a^{x-y} = \frac{m}{n}$

$\log_a\left(\frac{m}{n}\right) = x - y$

$= \log_a m - \log_a n$

(vi) Find the value of x: $\log x = 0.0044.$

Ans $\log x = 0.0044$

$x = \text{antilog}\ (0.0044)$

$x = 1.010$

(vii) Define algebraic expression.

Ans When operations of addition and subtraction ar applied to algebraic terms, we obtain an algebrai expression. For example

$$5x^2 - 3x + \frac{2}{\sqrt{x}},\ 3xy + \frac{3}{x}$$

(viii) Simplify: $2(6\sqrt{5} - 3\sqrt{5}).$

Ans $2(6\sqrt{5} - 3\sqrt{5})$

$= 2\sqrt{5}(6 - 3)$

$= 2\sqrt{5}(3)$

$= 2 \times 3 \times \sqrt{5}$

$= 6\sqrt{5}$

(ix) Factorize: $6x^4 - 96.$

Ans $6x^4 - 96 = 6(x^4 - 16)$

$= 6[(x^2)^2 - (4)^2]$

$= 6(x^2 - 4)(x^2 + 4)$

$= 6[(x)^2 - (2)^2](x^2 + 4)$

$= 6(x - 2)(x + 2)(x^2 + 4)$

3. Write short answers to any Six (6) questions: 12

(i) Define H.C.F.

Ans If two or more algebraic expressions are given then their common factor of highest power is called the H.C.F of the expressions.

(ii) What is meant by extraneous roots?

Ans When raising each side of the equation to a certain power may produce a non-equivalent equation that has more solution than the original equation. These additional solutions are called extraneous solution.

(iii) Find the solution set of: $|x + 2| - 3 = 5 - |x + 2|$.

Ans

$$|x + 2| - 3 = 5 - |x + 2|$$

$$|x + 2| + |x + 2| = 5 + 3$$

$$2|x + 2| = 8$$

$$|x + 2| = 4$$

$x + 2 = +4$ or $x + 2 = -4$

$x = 4 - 2$; $x = -4 - 2$

$x = 2$; $x = -6$

(iv) What is meant by cartesian plane?

Ans The cartesian plane establishes one-to-one correspondence between the set of ordered pairs $R \times R = \{(x, y) \mid x, y \in R\}$ and the points of the cartesian plane.

(v) What are vertical and horizontal lines?

Ans A line parallel to the x-axis is called horizontal line while to the y-axis, it is called vertical line.

(vi) Define coordinate geometry.

Ans Coordinate geometry is the study of geometrical shapes in the cartesian plane.

(vii) Find the mid-point of (8, 0)(0, –12).

Ans $R(x, y) = R\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$$= R\left(\frac{8+0}{2}, \frac{0-12}{2}\right)$$

$$= R\left(\frac{8}{2}, \frac{-12}{2}\right)$$

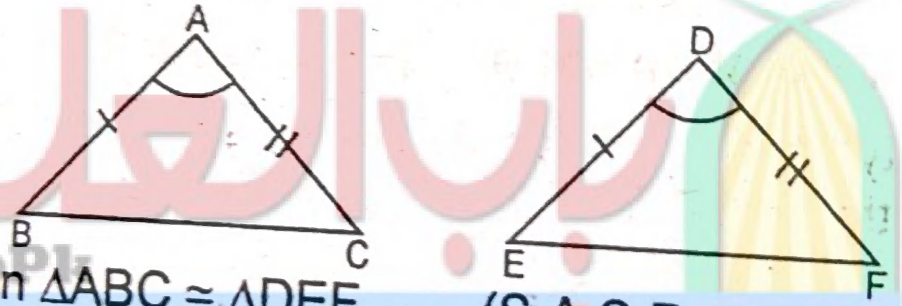
$$= R(4, -6)$$

(viii) Define S.A.S. postulate.

Ans In any correspondence of two triangles, if two sides and their included angle of one triangle are congruent to the corresponding two sides and their included angle of the other, then the triangles are congruent.

In $\Delta ABC \longleftrightarrow \Delta DEF$, shown in the following figures,

$$\text{if} \begin{cases} \overline{AB} \cong \overline{DE} \\ \angle A \cong \angle D \\ \overline{AC} \cong \overline{DF} \end{cases}$$



then $\Delta ABC \cong \Delta DEF$ (S.A.S Postulate)

(ix) Define trapezium.

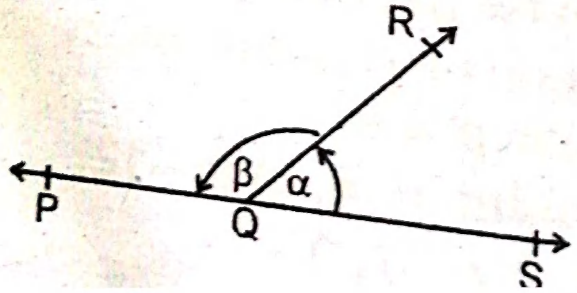
Ans Trapezium is a quadrilateral with one pair of sides parallel.

4. Write short answers to any Six (6) questions: 12

(i) Define supplementary angles. Give an example.

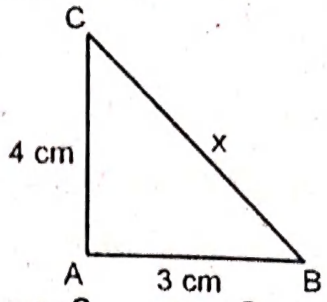
Ans Supplementary angles are two angles whose sum is 180°. If the sum of two angles is 180°, then each angle is called the supplement of the other.

For example, in the following figure, $\angle\alpha$ and $\angle\beta$ are supplementary angles.



(ii) If 3 cm and 4 cm are lengths of two sides of a right angle triangle, then what should be the third length of the triangle?

Ans By pythagoras theorem

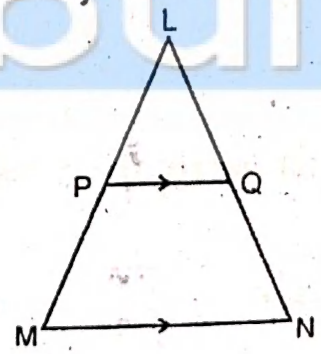


$$(BC)^2 = (AC)^2 + (AB)^2$$
$$x^2 = (4)^2 + (3)^2$$
$$= 16 + 9$$
$$= 25$$
$$\sqrt{x^2} = \sqrt{25}$$
$$x = 5 \text{ cm}$$

(iii) Define proportion.

Ans Equality of two ratios is defined as the proportion. If a : b = c : d; then a, b, c and d are said to be a proportion.

(iv) In Δ LMN, $\overline{MN} \parallel \overline{PQ}$ If m $\overline{LM}$ = 5 cm, m $\overline{LP}$ = 2.5 cm and m $\overline{LQ}$ = 2.3 cm, then find m $\overline{LN}$.



Ans

$m\overline{LM} = 5cm$

$m\overline{LP} = 2.5$ cm $m\overline{LQ} = 2.3$ cm

$m\overline{LN} = ?$

We know

$$\frac{m\overline{LM}}{m\overline{LP}} = \frac{m\overline{LN}}{m\overline{LQ}}$$

$$\frac{5}{2.5} = \frac{m\overline{LN}}{2.3}$$

$$2.5\ m\overline{LN} = (5)(2.3)$$

$$m\overline{LN} = \frac{(5)(2.3)}{2.5}$$

$$= 4.6 \text{ cm}$$

(v) Define Pythagoras theorem.

Ans In a right angled triangle, the square of the length of hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

(vi) Verify that triangle having following measures of sides is right-angled:

a = 5 cm, b = 12 cm, c = 13 cm

Ans We know that

$$c^2 = a^2 + b^2$$

$$(13)^2 = (5)^2 + (12)^2$$

$$169 = 25 + 144$$

$$169 = 169$$

Hence given sides represents right angle triangle.

(vii) Define area of a parallelogram.

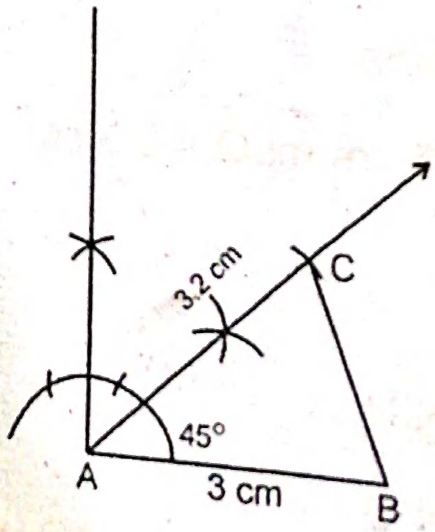
Ans The product of base and altitude is the area of any parallelogram ABCD. Area = Base × altitude

(viii) Construct ΔABC, in which : $m\overline{AB}$ = 3 cm, $\overline{AC}$ = 3.2 cm, $m\angle A = 45^\circ$.

Ans

$m\angle BAC = 45^\circ$

ΔABC



(ix) **Define circumcentre of a triangle.**

Ans The point of concurrency of the perpendicular bisectors of the sides of a triangle is called its circumcenter.

(Part-II)

NOTE: Attempt Three (3) questions in all. But question No. 9 is Compulsory.

Q.5.(a) Solve with the help of Cramer's rule: (4)

$$3x - 2y = -6$$

$$5x - 2y = -10$$

Ans $3x - 2y = -6,\ 5x - 2y = -10$

Writing eqs. in matrix form

$$\begin{bmatrix} 3 & -2 \\ 5 & -2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -6 \\ -10 \end{bmatrix}$$

$$A = \begin{bmatrix} 3 & -2 \\ 5 & -2 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 3 & -2 \\ 5 & -2 \end{vmatrix} = -6 + 10 = 4$$

$$A_x = \begin{bmatrix} -6 & -2 \\ -10 & -2 \end{bmatrix}$$

$$|A_x| = \begin{vmatrix} -6 & -2 \\ -10 & -2 \end{vmatrix}$$

$$= (-6)(-2) - (-10)(-2)$$

$$= +12 - 20$$

$$|A_x| = -8$$

$$A_y = \begin{bmatrix} 3 & -6 \\ 5 & -10 \end{bmatrix}$$

$$|A_y| = \begin{vmatrix} 3 & -6 \\ 5 & -10 \end{vmatrix}$$

$$= (3)(-10) - (5)(-6)$$

$$= -30 + 30$$

$$|A_y| = 0$$

$$x = \frac{|A_x|}{|A|} \quad ; \quad y = \frac{|A_y|}{|A|}$$

$$= \frac{-8}{4} \quad ; \quad = \frac{0}{4}$$

$x = -2$; $y = 0$

(b) Simplify: $\dfrac{(243)^{-2/3}\,(32)^{-1/5}}{\sqrt{(196)^{-1}}}$ (4)

Ans

$$\frac{(243)^{-2/3}\,(32)^{-1/5}}{\sqrt{(196)^{-1}}}$$

$$= \frac{(3^5)^{-2/3} \times (2^5)^{-1/5}}{\sqrt{(2 \times 2 \times 7 \times 7)^{-1}}}$$

$$= \frac{3^{-10/3} \times (2)^{-1}}{(2^2 \times 7^2)^{-1/2}}$$

$$= \frac{(2^2 \times 7^2)^{1/2}}{3^{10/3} \times (2)^1}$$

$$= \frac{2^{2 \times 1/2} \times 7^{2 \times 1/2}}{3^{9/3}.3^{1/3} \times 2}$$

$$= \frac{\cancel{2} \times 7}{3^3 \times 3^{1/3} \times \cancel{2}}$$

$$= \frac{7}{27\sqrt[3]{3}}$$

Q.6.(a) Use log tables to find the value of:

$$\frac{83 \times \sqrt[3]{92}}{127 \times \sqrt[5]{246}}$$ (4)

Ans Let

$$x = \frac{83 \times \sqrt[3]{92}}{127 \times \sqrt[5]{246}}$$

By taking log:

$$\log x = \log \frac{83 \times \sqrt[3]{92}}{127 \times \sqrt[5]{246}}$$

$$= \log (83) + \log (92)^{1/3} - \log (127) - \log (246)^{1/5}$$

$$= \log (83) + \frac{1}{3}\log (92) - \log 127 - \frac{1}{5}\log (246)$$

$$= 1.9191 + \frac{1}{3}(1.9638) - 2.1038 - \frac{1}{5}(2.3909)$$

$$= 1.9191 + 0.6546 - 2.1038 - 0.4782$$

$$\log x = -0.0083$$

$$= (1 - 0.0083) - 1$$

$\log x = \bar{1}.9917$

$x = \text{antilog } \bar{1}.9917$

$x = 0.9811$

(b) If $\left(3x + \frac{1}{3x}\right) = 5$, then find the value of $\left(27x^3 + \frac{1}{27x^3}\right)$. **(4)**

Ans Given

$$3x + \frac{1}{3x} = 5$$

Taking cube on both sides

$$\left(3x + \frac{1}{3x}\right)^3 = (5)^3$$

$$(3x)^3 + \left(\frac{1}{3x}\right)^2 + 3(3x)\left(\frac{1}{3x}\right)\left(3x + \frac{1}{3x}\right) = 125$$

$$27x^3 + \frac{1}{27x^3} + 3(5) = 125$$

$$27x^3 + \frac{1}{27x^3} + 15 = 125$$

$$27x^3 + \frac{1}{27x^3} = 125 - 15$$

$$27x^3 + \frac{1}{27x^3} = 110$$

Q.7.(a) Factorize: $81x^4 + 36x^2y^2 + 16y^4$. **(4)**

Ans

$$81x^4 + 36x^2y^2 + 16y^4$$
$$= (9x^2)^2 + 72x^2y^2 + (4y^2)^2 - 36x^2y^2$$
$$= (9x^2 + 4y^2)^2 - (6xy)^2$$
$$= (9x^2 + 4y^2 + 6xy)(9x^2 + 4y^2 - 6xy)$$
$$= (9x^2 + 6xy + 4y^2)(9x^2 - 6xy + 4y^2)$$

(4)

(b) Simplify:

$$\left(\frac{x^2 + y^2}{x^2 - y^2} - \frac{x^2 - y^2}{x^2 + y^2}\right) \div \left(\frac{x + y}{x - y} - \frac{x - y}{x + y}\right).$$

Ans

$$\left(\frac{x^2 + y^2}{x^2 - y^2} - \frac{x^2 - y^2}{x^2 + y^2}\right) \div \left(\frac{x + y}{x - y} - \frac{x - y}{x + y}\right)$$

$$\left[\frac{(x^2+y^2)^2-(x^2-y^2)^2}{(x^2-y^2)(x^2+y^2)}\right] \div \left[\frac{(x+y)^2-(x-y)^2}{(x-y)(x+y)}\right]$$

$$= \left[\frac{(x^4+2x^2y^2+y^4)-(x^4-2x^2y^2+y^4)}{(x^2-y^2)(x^2+y^2)}\right] \div \left[\frac{(x^2+2xy+y^2)-(x^2-2xy+y^2)}{(x^2-y^2)}\right]$$

$$= \left[\frac{x^4+2x^2y^2+y^4-x^4+2x^2y^2-y^4}{(x^2-y^2)(x^2+y^2)}\right] \div \left[\frac{x^2+2xy+y^2-x^2+2xy-y^2}{x^2-y^2}\right]$$

$$= \left[\frac{4x^2y^2}{(x^2-y^2)(x^2+y^2)}\right] \div \left[\frac{4xy}{x^2-y^2}\right]$$

$$= \frac{4x^2y^2}{(x^2-y^2)(x^2+y^2)} \times \frac{x^2-y^2}{4xy}$$

$$= \frac{xy}{x^2+y^2}$$

Q.8.(a) Find the solution set of: (4)

$$\frac{2x}{x-1}+\frac{1}{3}=\frac{5}{6}+\frac{2}{x-1}, \quad x \neq 1.$$

Ans

$$\frac{2x}{x-1}+\frac{1}{3}=\frac{5}{6}+\frac{2}{x-1}$$

$$\frac{3(2x)+(x-1)}{3(x-1)}=\frac{5(x-1)+2(6)}{6(x-1)}$$

$$\frac{6x+x-1}{3x-3}=\frac{5x-5+12}{6x-6}$$

$$\frac{7x-1}{3x-3}=\frac{5x+7}{6x-6}$$

$$(6x-6)(7x-1)=(3x-3)(5x+7)$$

$$42x^2-6x-42x+6=15x^2+21x-15x-21$$

$$42x^2-48x+6=15x^2+6x-21$$

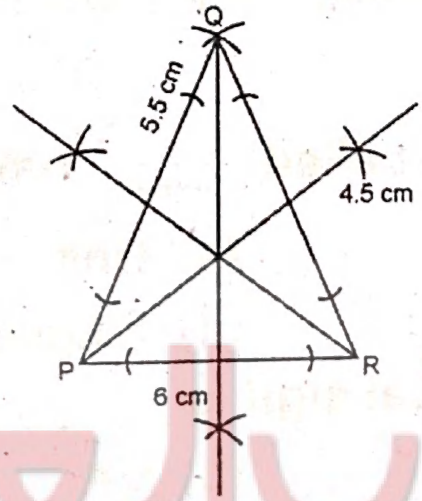
$$42x^2-15x^2-48x-6x+6+21=0$$

$$27x^2 - 54x + 27 = 0$$
$$27(x^2 - 2x + 1) = 0$$
$$x^2 - 2x + 1 = 0$$
$$(x - 1)^2 = 0$$
$$x = 1$$

(b) Construct Δ PQR and draw their altitudes:

$m\overline{PQ}$ = 5.5 cm, $m\overline{QR}$ = 4.5 cm, $m\overline{PR}$ = 6 cm

Ans



Constructive Procedure:

1. Take $\overline{PR}$ line as 6 cm long.
2. At point P, draw a 5.5 cm arc; and at point R, draw 4.5 cm arc. Both of them cut each other at point Q.
3. Join Q with P and R.
4. Then, draw relevant altitudes of P, Q and R.
5. Thrice of these altitudes are concurrent.

Q.9. The bisector of the angles of a triangle are concurrent. **(4)**

Ans For Answer see Paper 2014, (Group-I), Q.9.

OR

Triangles on equal bases and of equal altitudes are equal in area.

Ans For Answer see Paper 2014, (Group-I), Q.9.(OR).